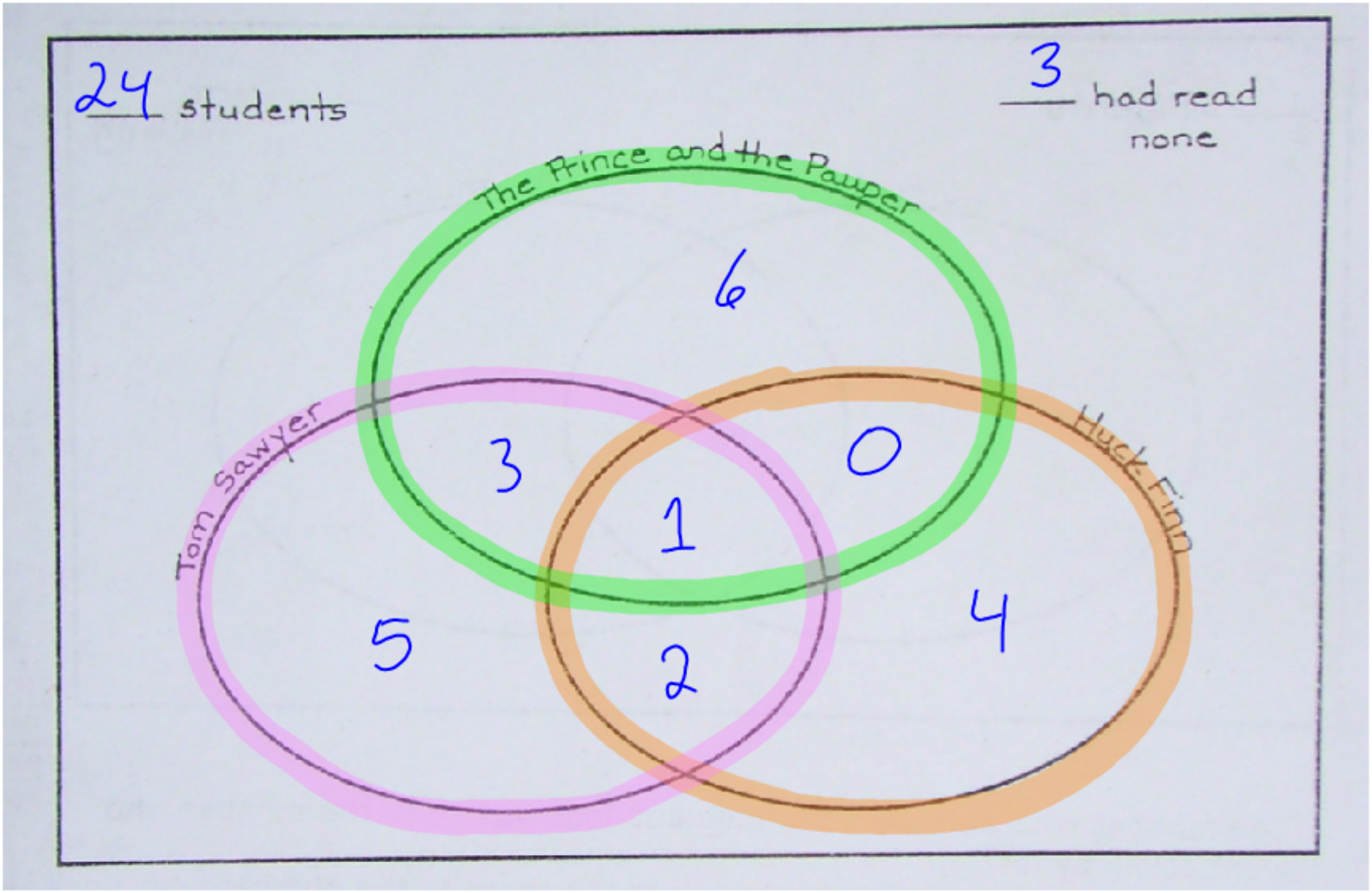
In Missouri the group of 24 students visited Hannibal, the home of Mark Twain.

- 11 of the students had read Twain's book *The Adventures of Tom Sawyer.*
- 7 had read his book *The Adventures of Huckleberry Finn.*
- 10 had read his book *The Prince and the Pauper.*
- 3 had read both *The Adventures of Huckleberry Finn* and *The Adventures of Tom Sawyer.*
- 4 had read both *The Adventures of Tom Sawyer* and *The Prince and the Pauper.*
- 1 had read both *The Prince and the Pauper* and *The Adventures of Huckleberry Finn.*
- 1 had read all 3 stories.

How many had read none of the 3 books by Twain?


24 students
3 had read none
The Prince and the Pauper
Tom Sawyer
Huck Finn
6
3
0
1
5
2
4

1 How many different five-digit numbers can be formed from the digits 1, 2, 3, 4, and 5 if each digit is used only once?

1) 120
2) 60
3) 24
4) 20

$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

$5!$ factorial

2 A locker combination system uses three digits from 0 to 9. How many different three-digit combinations with no digit repeated are possible?

1) 30
2) 504
3) 720
4) 1,000

$10 \cdot 9 \cdot 8 = 720$

12 A certain state is considering changing the arrangement of letters and numbers on its license plates. The two options the state is considering are:
Option 1: three letters followed by a four-digit number with repetition of both letters and digits allowed
Option 2: four letters followed by a three-digit number without repetition of either letters or digits
[Zero may be chosen as the first digit of the number in either option.]
Which option will enable the state to issue more license plates? How many *more* different license plates will that option yield?

Option 1: $26 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 175{,}760{,}000$

Option 2: $26 \cdot 25 \cdot 24 \cdot 23 \cdot 10 \cdot 9 \cdot 8 = 258{,}336{,}000$

13 In Jackson County, Wyoming, license plates are made with two letters (A through Z) followed by three digits (0 through 9). The plates are made according to the following restrictions:

- the first letter must be J or W, and the second letter can be any of the 26 letters in the alphabet
- no digit can be repeated

How many different license plates can be made with these restrictions?

2) All seven-digit telephone numbers in a town begin with 746. How many telephone numbers may be assigned in the town if the last four digits do not begin or end in a zero.

$\underline{9} \cdot \underline{10} \cdot \underline{10} \cdot \underline{9} = 8{,}100$

① P, S, M, O, A

~~5·4·3·2·1~~

P - S
P - M
P - O
P - A

10

$\frac{5}{\_} \cdot \frac{4}{\_} = 20 \div 2 = 10$

S - M
S - O
S - A

M - O
M - A

O - A

② P, S, M, O, A

P - S < M, O, A

P - M < O, A

P - O - A

S - M < O, A

S - O - A

M - O - A

10

$5 \cdot 4 \cdot 3 = 60 \div 6 = 10$

PSM
PMS
SPM
SMP
MPS
MSP
} 6

2 item - 2 repeats
3 items - 6 repeats
4 items - 24
5 items - 120

Repeats is the number factorial

4 toppings $5 \cdot 4 \cdot 3 \cdot 2 \div 4!$

factorial gives all the ways to arrange n items

(3) 7 possible toppings

Choose 2 toppings
order does not matter

$\underline{7} \cdot \underline{6} \div 2! = \boxed{21}$ $\quad {}_7C_2$

Choose 3 toppings $\quad {}_7C_3$

$\underline{7} \cdot \underline{6} \cdot \underline{5} = 210 \div 3! = \boxed{35}$

(36)

$_9C_3 = \underline{9}\ \underline{8}\ \underline{7} \div 3! = 84$

$_{10}C_2 = \underline{10} \cdot \underline{9} \div 2! = 45$

$_{20}C_4 = \underline{20}\ \underline{19}\ \underline{18}\ \underline{17} \div 4! = 4,845$

$_5C_1 = \underline{5} \div 1! = 5$

Bowls → order doesn't matter, take out repeats

Cones → order matters, don't divide